

## DISPOSABLE DIAPER

## BACKGROUND OF THE INVENTION

This invention relates to a disposable diaper for  
5 absorption and containment of excrement.

Japanese Patent Application Publication No. 1996-280739A  
describes a disposable diaper comprising a pants-shaped outer  
sheet and an absorbent panel attached to an inner surface of  
the outer sheet. The absorbent panel longitudinally extends  
10 across a crotch region of the outer sheet into front and rear  
waist regions. This absorbent panel comprises a liquid-  
pervious sheet, a liquid-impervious sheet and an absorbent  
member disposed between these two sheets. With this disposable  
diaper, worn by a wearer, the outer sheet elastically  
15 stretchable in a direction surrounding the wearer's waist  
region causes the absorbent panel to be closely fit to the  
wearer's body.

Japanese Patent Application Publication No. 1996-38546A  
describes a pants-type disposable diaper provided on an inner  
20 side of the pants with an absorbent pad structure which  
longitudinally extends across a crotch region of the pants into  
front and rear waist regions. This absorbent pad structure  
comprises a liquid-pervious topsheet, a liquid-impervious

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backsheet and an absorbent member disposed between these two sheets. With this diaper worn, elastically stretchable side sheets provided on the pants cause the absorbent pad structure to be closely fit to the wearer's body.

5 In the diaper generally comprising a pants-type cover member and a body fluid absorbent member attached to an inner side of the cover member like those described in the Publication, the absorbent member has a liquid-pervious topsheet intended to be fit to a wearer's skin, a backsheet  
10 opposed to the topsheet and an absorbent core disposed between these two sheets wherein the backsheet is covered with the pants-type cover member. With such a diaper worn, the pants-type cover member is pressed against the backsheet of the absorbent member which is thereby pressed against a wearer's  
15 skin. In this manner, the backsheet of the absorbent member is covered with the relatively thick pants-type cover member, so air permeability of the diaper may be reduced even if an air permeable and liquid-impervious sheet is used as the backsheet. As a result, the wearer's skin against which this  
20 absorbent member is pressed may suffer from an uncomfortable stuffiness. Such a trouble may be occur not only with the pants-type cover member but also with an open-type cover member.

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## SUMMARY OF THE INVENTION

It is an object of this invention to provide an improved air permeability to a disposable diaper comprising a cover member adapted to cover front and rear waist regions as well as a crotch region of a wearer's body of the diaper and an absorbent member adapted to be attached to an inner side of this cover member.

According to this invention, there is provided a disposable diaper comprising a cover member composed of front and rear waist regions and a crotch region and a body fluid absorbent member attached to an inner side of the cover member.

In one embodiment of this invention, the body fluid absorbent member extends in a longitudinal direction defined across the crotch region into the front and rear waist regions, having front and rear end portions fixed to an inner surface of the cover member at the front and rear end portions thereof. The body fluid absorbent member includes a liquid-pervious topsheet includes to be placed against the wearer's body, a backsheet be placed against the inner surface of the cover member and a body fluid absorbent core disposed between these two sheets. The absorbent core is formed on a side of the backsheet with a plurality of groove concaved in a direction from the backsheet toward the topsheet and extending in one of

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the longitudinal direction and the direction being orthogonal to the longitudinal direction.

## BRIEF DESCRIPTION OF THE DRAWINGS

5        Fig. 1 is a perspective view showing one embodiment of a disposable diaper according to this invention;

Fig. 2 is a partially cutaway plan view showing the disposable diaper as having been unfolded;

10       Fig. 3 is a sectional view taken along a line III - III in Fig. 2;

Fig. 4 is a sectional view taken along a line IV - IV in Fig. 2;

Fig. 5 is a sectional view taken along a line V - V in Fig. 2;

15       Fig. 6 is a sectional view taken along a line VI - VI in Fig. 2;

Fig. 7 is a sectional view similar to that in Fig. 4 but showing another embodiment of this invention;

20       Fig. 8 is a plan view similar to that in Fig. 2 but showing still another embodiment of this invention;

Fig. 9 is a sectional view taken along a line IX - IX in Fig. 8; and

Fig. 10 is an enlarged sectional view showing a part of

Fig. 9.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Details of a disposable diaper according to this invention will be more fully understood from the description given hereunder with reference to the accompanying drawings.

A disposable diaper 1 shown in Fig. 1 in a perspective view is of a pants-type and comprises a pants-type cover member 2 adapted to cover a wearer's waist regions and crotch region and a body fluid absorbent member 3 attached to an inner side of the cover member 2. The cover member 2 is composed of a front waist region 6, a rear waist region 7 and a crotch region 8 positioned between these two waist regions 6, 7. The front and rear waist regions 6, 7 are overlaid upon and joined to each other along transversely opposite side edge portions 11, 12, of them at a plurality of joining zones 13 arranged intermittently in a longitudinal direction of the diaper 1 along the respective side edge portions 11, 12. Such diaper 1 has a waist-opening 10a and a pair of leg-openings 10b of which respective peripheral edge portions are provided with elastic members 22, 23 (See Fig. 2 also) as indicated by chain lines.

Fig. 2 is a plan view of the diaper 1 in which the side edge portions 11, 12 connecting the front and rear waist regions

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6, 7 to each other have been separated from one another and then the diaper 1 has been unfolded in opposite directions as indicated by arrows 14, 15 in Fig. 1. In the diaper 1 unfolded in this manner, the cover member 2 comprises an inner sheet 16 and an outer sheet 17 of an hour glass shape which are identical in shape as well as in size and intermittently bonded to each other by means of appropriate adhesive such as a hot melt adhesive or welding technique. Along longitudinally opposite end portions 18, 19 of the front and rear waist regions 6, 7, respectively, and along transversely opposite side edge portions 21 of the crotch region 8, of the cover member 2, elastic members 22 associated with the waist-opening and elastic members 23 associated with the respective leg-openings are attached under tension to an inner surface of either of the inner sheet 16 or the outer sheet 17. The absorbent member 3 extends longitudinally across the crotch region 8 into the front and rear waist regions 6, 7 of the cover member 2 and has front and rear end portions 26, 27, which are bonded to the end portions 18, 19 of the front and rear waist regions 6, 7 by means of a hot melt adhesive 28 (See Fig. 6) or detachably attached to these end portions 18, 19 by other means such as a pressure-sensitive adhesive or a mechanical fastener well known under the trade name of "MAGIC TAPE". Transversely opposite side edge portions

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29 of the absorbent member 3 extending between the front and rear end portions 26, 27 are provided with leak-barrier cuffs 31 which have openings toward a transversely middle zone of the absorbent member 3. Elastic members 33 extending between the front and rear end portions 26, 27 are attached under tension to inner edge portions 32 of the leak-barrier cuffs 31. The absorbent member 3 is as indicated by chain lines in Fig. 2 formed on its backsheet 37 with a first groove 44 (See Fig. 4).

Figs. 3 ~ 5 are respectively sectional views taken along lines III - III, IV - IV and V - V extending in the transverse direction, respectively, in Fig. 2. Referring to Fig. 3 showing the diaper 1 in the sectional view taken along the line III - III extending across the crotch region 8 and bisecting the diaper 1 into front and rear halves, the absorbent member 3 comprises a liquid-pervious topsheet 36 destined to contact with the wearer's skin, the previously described backsheet 37 which is preferably liquid-impervious and destined to contact with the inner sheet 16 of the cover member 2 and a body fluid absorbent core 38 disposed between the top- and backsheets 36, 37. The core 38 contains hydrophilic fibers 61 and superabsorbent polymer particles 62 and longitudinally extends toward the front and rear end portions 26, 27 of the absorbent member 3 in a rectangular shape. The top- and backsheets 36,

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37 extend outwardly beyond a peripheral edge of the core 38 and are joined together water-tight by using an appropriate adhesive or welding technique. Along the opposite side edge portions 29 of the absorbent member 3, the backsheet 37 which is joined with the topsheet 36 extends outwardly beyond the side edges of the topsheet 36 and these extensions of the backsheet 37 are folded inwardly in the transverse direction of the absorbent member 3 forming the respective leak-barrier cuffs 31. Portions of these leak-barrier cuffs 31 lying on the front and rear end portions 26, 27 of the absorbent member 3 are joined to these front and rear end portions 26, 27 using an adhesive 40 or welding technique. In a state where the absorbent member 3 is longitudinally curved in U-shape (See Fig. 1), contraction of elastic members 33 associated with the leak-barrier cuffs 31 makes the leak-barrier cuffs 31 to rise and form openings 39 oriented toward the transversely middle zone of the absorbent member 3. In this transversely middle zone, the backsheet 37 is bonded to an inner surface of the cover member 2 by means of adhesive 30.

Now referring to Fig. 4 showing the diaper 1 in the sectional view taken along the line IV - IV extending aside toward the rear waist region 7 with respect to the line III - III dividing the diaper 1 into front and rear sections as viewed

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in the longitudinal direction as indicated in Fig. 2, the absorbent member 3 is formed on the side of the backsheet 37 with a pair of the first groove 41 (See Fig. 5) concaved toward the topsheet 36 and longitudinally extending toward the front and rear end portions 26, 27. Each of the first groove 41 preferably has a width of about 2 - 20 mm and a depth corresponding to about 1/4 - 3/4 of the thickness of the core 38, and has its inner side with the backsheet 37. The core 38 is disposed between the backsheet 37 defining the inner side of the respective first groove 41 and the topsheet 36 opposed to the backsheet 36. The first groove 41 is intended to maintain, between the absorbent member 3 and the member 2, clearances serving to improve permeability of the diaper 1 even when these members 2, 3 are brought into a close contact.

Referring to Fig. 5 showing the diaper 1 in the sectional view taken along the line V - V extending in the transverse direction along the end portion 19 of the cover member 2 as indicated in Fig. 2, the portions of the top- and backsheets 36, 37 extending outwardly beyond the peripheral edge of the core 38 are overlaid and bonded to the cover member 2 using an adhesive 42 or welding technique. It is also possible to attach these overlaying top- and backsheets 36, 37 in a detachable manner to the cover member 2 using an appropriate means such

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as pressure-sensitive adhesive.

Referring to Fig. 6 showing the diaper 1 in the sectional view taken along the line VI - VI extending between the front and rear end portions 18, 19 of the cover member 2 as indicated in Fig. 2, each of the first groove 41 is laid separated respectively in the crotch region 8 in the longitudinal direction by an appropriate spacing. If necessary, it is also possible to make all of the first groove 41 connected entirely, rather than laying separately the respective first groove 41 in the longitudinal direction. It should be understood here that, while the leak-barrier cuffs 31 are normally folded down onto the topsheet 36, these leak-barrier cuffs 31 are illustrated in Fig. 6 as being somewhat rising in order that the presence of these leak-barrier cuffs 31 can be apparently recognized.

While the diaper 1 of such a structure is worn, the cover member 2 and the absorbent member 3 are maintained to be spaced from each other along the first groove 41 even when these members 2, 3 are brought into a close contact with each other and thereby air permeability between the interior and the exterior of the absorbent member 3 can be improved. For example, an air permeable and liquid-impervious sheet may be used as a stock material for the backsheet 37 of the absorbent member 3 to ensure

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that a flow of air high in temperature and humidity can be guided from the interior of the core 38 through the backsheet 37 into the first groove 41 and freely moved therein without being hindered the cover member 2. With the inner and outer  
5 sheets 16, 17 of the cover member 2 being air permeable, a flow of air high in temperature and humidity introduced into the first groove 41 can be exhausted therefrom into the exterior of the diaper 1.

Fig. 7 is a view similar to Fig. 4 but showing another  
10 embodiment of this invention. The absorbent member 3 of this diaper 1 is formed with, in addition to the first groove 41 extending in the longitudinal direction, a pair of second groove 46 extending in the transverse direction, i.e., orthogonally to the first groove 41, between the transversely opposite side  
15 edge portions 29 of the absorbent member 3. These second groove 46 facilitate the flow of air high in temperature and humidity to be exhausted from the first groove 41 and thereby the air permeability of the absorbent member 3 is further improved. Preferably, one or more pieces of the second groove 46 with  
20 substantially the same dimension as the first groove 41 in width and depth may be installed against one piece of the first grooves 41.

Fig. 8 is a view similar to Fig. 2 but showing still another

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embodiment of this invention, Fig. 9 is a sectional view taken along a line IX - IX in Fig. 2 and Fig. 10 is an enlarged sectional view showing a part of Fig. 9. The diaper 1 shown in Figs. 8 - 10 has, in addition to the first groove 41 or both the first and second grooves 41, 46 formed on the side of the backsheet 36, a third groove 47 formed on the side of the topsheet 36 so as to extend in the longitudinal direction. Preferably, the absorbent member 3 is formed on the side of the topsheet 36 with at least one piece of the third groove 47 having an appropriate length and more preferably with at least two pieces of the third groove 47 each being spaced in the longitudinal direction in the crotch region 8 of the cover member 2. Referring to Fig. 8, the absorbent member 3 is formed along each of its transversely opposite side edge portions 29 with a pair of the third groove 47 spaced from each other in the longitudinal direction. Taking account of the fact that the presence of the third groove 47 tends to, in the same manner as the first groove 41 in the embodiment shown by Fig. 4, restrain the absorbent member 3 from being easily curved between the front and rear end portions 26, 27, it is preferred to separate each of the third groove 47 in the crotch region 8 so that the absorbent member 3 may be easily curved and thereby facilitated to fit to the wearer's crotch region. Each of the third groove 47

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preferably has a width of about 2 - 20 mm and a depth corresponding to about 1/4 - 3/4 of the thickness of the core 38. The third groove 47 formed in this manner can reduce an amount of body fluids permeated sideways and prevent body fluids from leaking sideways of the diaper 1 by introducing body fluids such as urine to be guided thereinto.

As is apparent from Fig. 10 showing the diaper 1 in the enlarged sectional view, the position of the third groove 47 substantially conforms to the position of the first groove 41 as viewed in the transverse direction of the diaper 1. With the first and third grooves 41, 47 formed on the side of the backsheet 37 and the side of the topsheet 36, respectively, in such an alignment, the absorbent member 3 is curved as indicated by imaginary lines and facilitated to follow a contour of the wearer's waist as the diaper 1 is worn. The first groove 41 is deformed with its width widened and the third groove 47 is deformed with its narrowed as the absorbent member 3 follows the contour of the wearer's waist in the waist-surrounding direction. Such deformation of the grooves 41, 47 advantageously facilitates the absorbent member 3 to follow the contour of the wearer's waist without formation of wrinkles on the side of the topsheet 36 even if the core 38 has a thickness of about 10 - 20 mm. Therefore, there is no anxiety that the

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presence of the topsheet 36 might give the wearer an uncomfortable feeling. In this way, the first groove 41 serving to improve the air permeability of the absorbent member 3 is preferably positioned to that of the third groove 47 so that the fitness of the absorbent member 3 around the wearer's waist also may be improved. More specifically, with the arrangement that the first groove 41 and the third groove 47 are positioned on the same position as illustrated in Fig. 10, it is preferred to dispose the core 38 between the first and third grooves 41, 47 so that the body fluids can be dispersed in the absorbent member 3 in the transverse direction through the core 38.

While this invention has been described hereinabove with respect to the pants-type disposable diaper as the typical embodiment thereof, this invention is applicable also to an open-type disposable diaper. The cover member 2 may be formed by a nonwoven fabric or plastic film both of which are preferably. The core 38 of the absorbent member 3 may be formed by a fluff pulp fibers 61 and superabsorbent polymer particles 62. The superabsorbent polymer particles 62 may be mixed with the fluff pulp fibers 61 and this mixture may be layered in the thickness direction of the core 38. The superabsorbent polymer particles 62 may be distributed with its density gradually

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increasing in the direction from the topsheet 36 toward the backsheet 37. The distribution density of the superabsorbent polymer particles 62 may be varied in the transverse direction of the absorbent member 3. For example, referring to Fig. 8, the distribution density of the superabsorbent polymer particles 62 may be adjusted to be higher in the zone defined between a pair of the third grooves 47, 47 than in the zones extending outside the pair of the third groove 47, 47. In any case, an amount of the superabsorbent polymer particles 62 used to form the core 38 is preferably about 2 - 98 % by weight of the core 38. Thermoplastic synthetic fiber having a melting point of  $100\text{ }^{\circ}\text{C} \pm 20\text{ }^{\circ}\text{C}$  may be mixed into the core material up to 20 % by weight to facilitate formation of the first - third groove 41, 46, 47 by heating the core 38 under a pressure.

The disposable diaper according to this invention has the first groove and the second groove formed on the side of the backsheet of the absorbent member which is attached to the inner side of the cover member. The grooves contribute to improvement of air permeability of the absorbent member itself as well as to the air permeability desired between this absorbent member and the cover member so that no stuffiness may occur even when the absorbent member is closely contacted with the wearer's skin.